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THE LARVA OF *PELECINUS POLYTURATOR* (DRURY) (HYMENOPTERA: PELECINIDAE)

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Abstract.—The first instar larva and exuviae of the last instar larva of *Pelecinus polyturator* (Drury) are described, illustrated, and compared with published descriptions of other larvae of Proctotrupoidea.

Key Words: larval morphology, Pelecinidae, Proctotrupoidea

The application of characters from larval morphology to the study of relationships within the Hymenoptera is very uneven. There are some good examples of the usefulness of immatures as an additional source of data (e.g., Evans 1987), but for many superfamilies little or nothing is known. Progress in this area is hindered for several reasons. Most Apocrita are parasitoids of other insects, and the hosts for a number of groups are very poorly known. Many species are internal parasitoids; thus it is difficult to obtain early instars and often the larvae are highly simplified in structure.

Within the Hymenoptera a remarkable array of larval body plans is found. Clausen (1940) outlined fourteen types among the parasitic Hymenoptera alone. Some of these are highly simplified, "embryonic," forms, while others possess well-developed, exaggerated mandibles and caudal appendages. Later instars usually converge upon a generalized, hymenopteriform type. Little phylogenetic pattern has been found amidst this variety; at present we are confronted with a diversity of forms without any underlying organizing principle.

The superfamily Proctotrupoidea s. str. is comprised of ten extant families of internal parasitoids. The hosts for three of these (Renyxidae, Austroniidae, and Peradeniidae) are unknown, and only a bare minimum of information is available for the Monomachidae and Roproniidae. The only families for which immature stages have been described are the Diapriidae (a large group of nearly 2,000 recognized species), Proctotrupidae (331 described species), and Heloridae (a relict group of 10 extant species). In total, the larvae of only six species from this complex have been described. We report here on the larvae of another family, the Pelecinidae, a small group (only one species currently recognized) of uncertain affinities (Rasnitsyn 1980, Dowton et al. 1997).

MATERIALS AND METHODS

Five parasitoid larvae were dissected from larvae of Scarabaeidae (Coleoptera), and preserved in ethanol. The specimens

were found in the posterior two-thirds of the abdomen of the host. Three final instar exuviae were found attached to scarab remains from which *Pelecinus* had pupated. Specimens are stored in the collections of JBJ; the Ohio State University; the Insect Research Collection, University of Wisconsin; and El Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas. Illustrations were made using a camera lucida of whole specimens under alcohol and exuviae in temporary slide mounts in glycerine jelly.

Pelecinus polyturator (Drury)

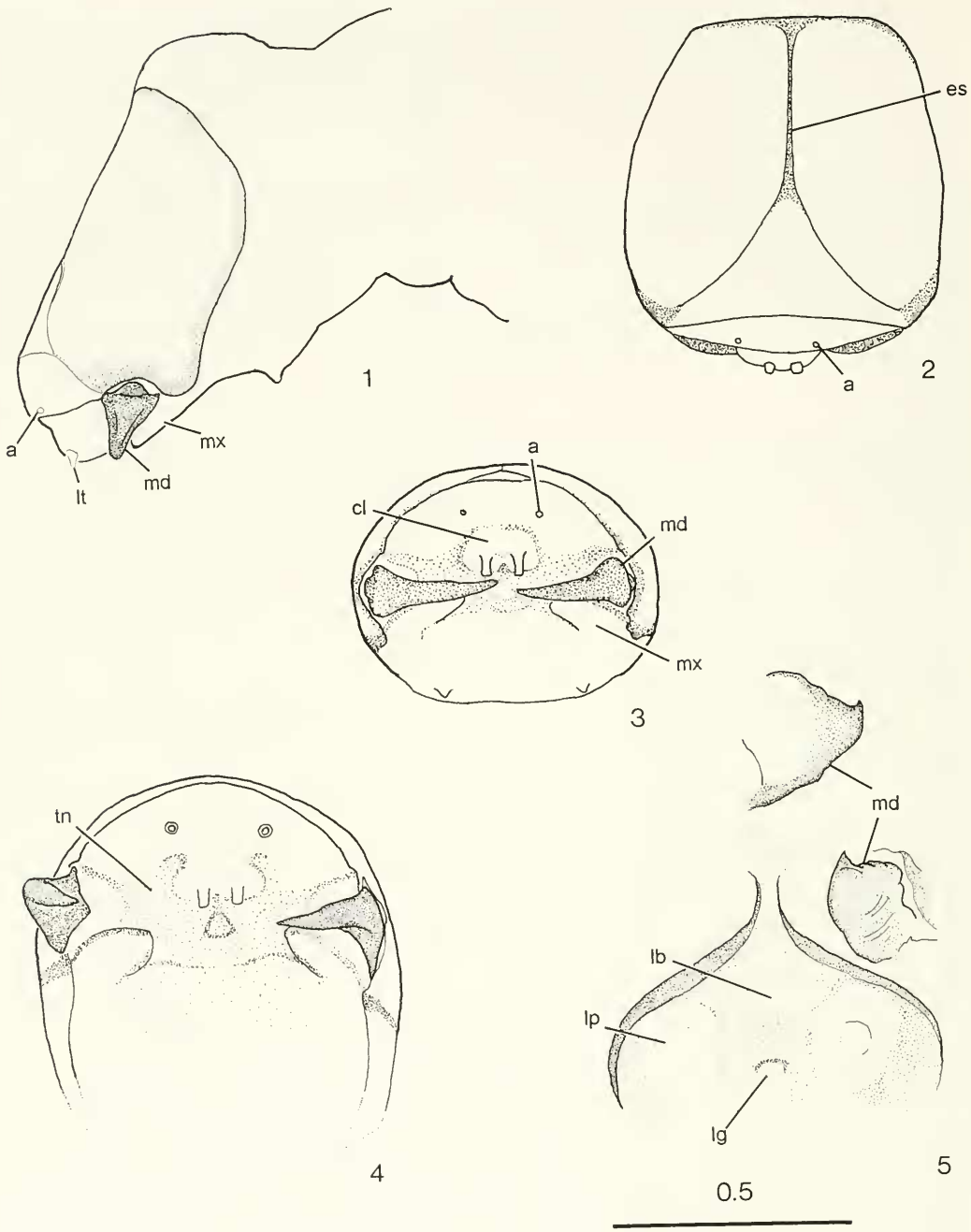
Material examined.—USA. Michigan, Newaygo Co., 18 April 1974, host in soil of oak forest, ex *Phyllophaga*, one first instar; Branch Co., 23 May 1974, hosts in soil of oak-hickory forest, four first instars, three from large 5 cm long larvae, probably *Phyllophaga*, one from small 2.5 cm larva, possibly *Serica* sp. Wisconsin, Marquette Co., 11 August 1992, in sandy soil of forest meadow, ex larva of *Phyllophaga drakei* (Kirby) one final instar exuviae; Jackson Co., 4 June 1992, ex *P. drakei*, one final instar exuviae; Oconto Co., 28 May 1996, ex *Phyllophaga rugosa* (Melsheimer), one final instar exuviae. MEXICO. Chiapas, Tenejapa, Balun Canal, 2,300 m, 14 February 1997, ex *Phyllophaga obsoleta* (Blanchard) third instar, one final instar exuviae.

First instar (Figs. 1–4).— Length 3.3–5.3 mm; mandibulate larva (Clausen 1940); head capsule well-developed, covering dorsal and lateral sides of head, margins darkly pigmented, sclerotization extending beyond margins, gradually disappearing posteriorly; epicranial suture (Fig. 2, *es*) well-developed; no indication of eyes; antenna (Figs. 1–3, *a*) indicated by small paired submedial papilla; clypeolabral area (Fig. 3, *cl*) largely membranous, supported by ovoid sclerotized ring, dorsal portion of this ring sometimes incomplete; labrum with two medial tubercles (Fig. 1, *lt*); mandible (Figs. 1, 3, *md*) strongly developed, falcate, bearing a small subapical tooth; maxilla (Fig. 1, 3, *mx*) supported anteriorly by narrow stipital sclerite, otherwise lobelike, membranous; maxillary palp, labium, and labial palp undifferentiated; head supported internally by extensive, strongly pigmented tentorium (Fig. 4, *tn*) in shape of central plate with anterior extensions continuous with labral sclerite, lateral arms surrounding base of mandibles, and broad posterior bilobed plate in labial region, a central ovoid foramen visible, anterior to this with more strongly pigmented triangular prominence, anterior apex of triangle produced into small costa extending into labrum; no prolegs visible; body with indeterminate number of segments, without setae, apex of abdomen acute; no spiracles visible.

Final instar (Fig. 5).—Head capsule with posterior sclerotized, pigmented band, otherwise largely membranous; mandible (*md*) very small, weakly articulated with head; antenna, labrum, maxilla, maxillary palp indistinguishable; labium (*lb*) visible as medial triangular raised surface behind mandibles, with large circular field corresponding to each labial palp (*lp*), a small central area presumably representing opening of labial gland (*lg*) between palpi; mouthparts unsupported by sclerotized pleurostoma or hypostoma; body with 7 pairs of spiracles visible; tracheae well-developed.

Discussion

The exuviae of the last instar larvae are associated with pharate adult *Pelecinus polyturator*, and their identity is unequivocal. The early instar larvae, however, are strikingly divergent in structure from the exuviae. Our determination of them was based on the fact that they were internal parasitoids dissected from larvae of *Phyllophaga* Harris (Coleoptera: Scarabaeidae), the only recorded host in the United States and Canada. The specimens also were collected in an area in which *Pelecinus* was very abundant. Muesebeck (1979) recorded *Tiphia berbereti* Allen, *T. tegulina* Malloch, *T. transversa* Say, *T. vulgaris* Robertson, and *T. intermedia* Malloch (Tiphiidae); *Myzin-*



Figs. 1–5. *Pelecinus polyturator*, larva. 1–4, Head of first instar. 1, Lateral view. 2, Dorsal view. 3, Frontal view, specimen with mandibles closed. 4, Frontal view, specimen with open mandibles exposing tentorium. 5, Mouthparts from final instar exuviae, right mandible detached. Abbreviations: a = antenna; cl = clypeolabral area; es = epicranial suture; lb = labium; lg = opening of labial gland; lp = labial palp; lt = labral tubercle; md = mandible; mx = maxilla; tn = tentorium. Scale in mm.

um quinquecinctum (Fabricius) (Tiphiidae); and *Ophion nigrovarius* Provancher (Ichneumonidae) as parasitoids of *Phyllophaga*. Woodruff and Beck (1989) listed a second species of *Ophion* as well as a number of additional species of tiphiids and scoliids. We ruled out the aculeates because they are external parasitoids. Ichneumonoids usually are characterized by the possession of a hypostomal spur (Short 1978), a structure that was not observed in these specimens.

Determination of the number of larval instars of internal parasitoids requires large numbers of observations of cohorts of known age in order to detect structural changes associated with molting. This has not been done yet for any species of proctotrupoid, and no one has yet been able to rear *Pelecinus* through its life cycle. We could not determine the age of the observed larvae directly or infer their age from published observations of related species. Clausen (1940) stated that the characteristics that set apart mandibulate larvae are lost at the first molt. This was confirmed by Clancy (1946) in his studies of *Helorus*, another proctotrupoid. Therefore, we concluded that the larvae dissected from the hosts must be late first instars.

Very little information on the immature stages of proctotrupoids exists to form a context in which to discuss the structural features of *Pelecinus*. Larvae have been described and illustrated for *Helorus anomalipes* (Panzer) (Heloridae; Clancy 1946), an unidentified species of *Basalys* Westwood (Diapriidae; Simmonds 1952), *Basalys tritoma* Thomson (Diapriidae; Wright et al. 1946), *Coptera silvestrii* (Kieffer) (Diapriidae; Pemberton and Willard 1918), *Paracodrus apterogynus* (Haliday) (Proctotrupidae; Zolk 1924), *Phaenoserphus viator* (Haliday) (Proctotrupidae; Eastham 1929), and *Brachyserphus parvulus* (Nees ab Esenbeck) (Proctotrupidae; Osborne 1960). Large, sickle-shaped mandibles have been reported in the first instar for all these species. A sclerotized head capsule was described in *H. anomalipes*, *B. tritoma*, and *C. silvestril. Phaenoserphus viator* lacks a complete head capsule, but does have a sclerotized ring surrounding the mouthparts. Distinct antennal lobes are found in the helorid, *Basalys* spp. and the proctotrupids, larger and more prominent than the structures found in *Pelecinus*. We observed no prolegs on any of the first instar larvae; these structures have been reported for *H. anomalipes*, *P. viator*, *B. parvulus*, and an unidentified proctotrupid (Clausen 1940; presumably *Nothoserphus scymni* Ashmead). Two of our specimens have paired, nipple-like protuberances beneath the posterior portion of the head capsule (visible in Fig. 1). Because of their position, we hesitate to call these prolegs or to homologize them with the labial palpi. The number of observed spiracles reported varies from three (*B. tritoma*, *C. silvestrii*) to ten pairs (*P. viator*).

The most striking feature we observed in the first-instar larva was the large tentorial endoskeleton. A similar structure was very briefly described in *P. viator* by Eastham (1929), suggesting that it may not have been as apparent or strongly pigmented as in *Pelecinus*. The tentorium is not mentioned in the other descriptions.

The larval specimens were dissected from hosts in the spring (18 April, 1974; 23 May, 1974) in Michigan. Therefore, it appears that the species overwinters as late first instars within the *Phyllophaga* larvae. No more than a single larva was found in any one host. Three specimens were recovered from large (5 cm) hosts, presumably the final instar of the beetle. A fourth was found in a much smaller larva, either a much younger specimen or a different genus, perhaps *Serica* MacLeay (Coleoptera: Scarabaeidae). Host size may contribute to the large variation in size of adult *Pelecinus*.

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